

Science Objectives:

ACOS # 4: Describe forms of energy, including chemical, heat, light, and mechanical. Identify types of potential and kinetic energy.

Essential questions:

What is energy? What is work? How are they related? What are potential and kinetic energy? How does the height of an inclined plane affect potential energy? How does mechanical energy relate to potential and kinetic energy?

Vocabulary:

energy, work, potential energy, kinetic energy, mechanical energy, stored mechanical energy, momentum

Basic Knowledge Acquisition:

Students recall what they know about energy and work through turn and talks.

Launcher:

Task presented to students "You are going to have to build a ramp for a marble powered race car. I have received a challenge from Fun Park Inc. to have my engineering students design a track that will propel a marble powered car the farthest distance. They are working on cutting down energy cost just like we are here at Collier, so they want to use clean energy, simply the force of a moving object for acceleration. We are going to see how the height of an inclined plane affects potential and kinetic energy and the ability to do work before we begin the engineering design process, so we can get some ideas for our design."

Activity/Procedure/Exploration:

Students work in groups to begin testing how the height of an inclined plane affects the movement of a cup by a marble at the bottom of the ramp. Students develop an effective means of testing, collecting, and analyzing the data gathered in the investigation. Students are then given the material choices, constraints, and considerations for their task. Students then apply their knowledge to design a ramp that will accomplish the goal of pushing their marble powered car the greatest distance. They are to examine materials, ask questions, brainstorm ideas, develop a plan, create their design, test their design, record their results, and improve their design while explaining their learning in an effective manner. Next, they are to evaluate, discuss, and provide input for what worked and what did not work based on their lab design. They must make connections among energy, work, and the movement of the cup and the position of the marble as it applies to ramp and marble powered car. Their design should reflect their learning, have clear measurable results, and provide basis for further prediction explaining their reasoning and the relationship between the height of an inclined plane and potential and kinetic energy. If time allows, they should discuss changes that could be made to the car design or propelling object that could better accomplish the task, and what kind of jobs may entail this type of design.

Closing:

Students explain how the height of an inclined plane affects energy as it relates to the concepts learned and explored in the lesson through writing their conclusions with an explanation of their reasoning. Students apply their knowledge to new situations by working on solving related real-world problems in groups, again explaining their reasoning.

Materials:

cups, marbles, ruler, wooden blocks, measuring tape, paper, record sheet, notebooks, colored pencils/crayons, folders, index cards, straws, felt, foil, lab sheet

Evaluation:

Teacher Observation (questioning & feedback) and Student Work (performance, discussion, application, & reflection)